

## Slovenia

### RES-e Map: Electricity from renewable energy sources (RES-e)



<b>The region</b>	Slovenia
<b>Number of inhabitants</b>	2 Mio
<b>Size (in km<sup>2</sup>)</b>	20.273 km <sup>2</sup>
<b>Capital</b>	Ljubljana

#### Short description:

The Republic of Slovenia lies at the heart of Europe where the Alps and the Mediterranean meet the Pannonian plains and the mysterious Karst. The official language is Slovene, one of the South Slavonic languages. As a small, beautiful and picturesque country, Slovenia makes a great tourist destination. Within a small modest, Slovenia contains mountains, lakes, waterfalls, forests, caves, hills, plains, rivers and the sea as well as many natural and landscape parks. With attainment of independence, Slovenia introduces a market orient economy that achieves dynamic increase. 47.000 privately undertaking was established. The most important sectors are processing industry, trade, immovable, transport and communication. Industry represents 75% of Slovene export, mostly engines and transport installations. Tourism should also be mentioned, which brings important income to Slovene.

**Share of RES** (total primary energy): 10.8 %

**Share of RES-e** (total electricity): 30.6 %

**Target RES-e (national):** 33.6 % (2010) incl. big Hydro, 4.2 % (2010) excl. big Hydro

#### The partner organisation:

- University of Ljubljana, Faculty of Mechanical Engineering, Center for Energy and Environment Technologies (technology analysis of renewable energy sources)

	Num-ber of plants	Total installed capacity (MW)	Typical installation size	Main pre-sent funding mechanism	Short-term per-spective (2007)	Mid/long-term per-spective (2015)	Main barriers
<b>Wind</b>	1	0,006	6 kW	feed-in tariff	low	high	high visual influence into space, protective areas (Natura 2000)
<b>Wood biomass</b>	5	6	1000 kW	feed-in tariff	medium	high	high investment costs
<b>Biogas</b>	9	7	750 kW	feed-in tariff	low/medium	medium	public opposition
<b>PV</b>	30	0.038	1.2 kW	feed-in tariff	low	high	high investment costs
<b>Hydro &lt;10 MW</b>	400	>150	>100 kW	feed-in tariff	medium	high	Complicated proceeding for taking out of licence and acquisition of building permit
<b>Other RESe: geothermal</b>	0	0	0	feed-in tariff	medium	high	ignorance of technologies

## Wind

**The past:** Measures for the needs of energy exploitation began at the end of the year 1998. The measure stations was set up on the following locations: Sinji vrh on Gora above Ajdovščina, Hribač on Nanos, Slatna on Vremščica, Volovja reber at Ilirska Bistrica, Bate above Nova Gorica, Golič at Rakitovec, Trstelj at Komen and Kokoš at Lipica.

**The present:** Today only one wind power plant operates on Kredarica, but produced electrical energy is not being sold to the network. In the year 2004 green light for setting up of 47 wind turbines on Volovja Reber was given. Their power should be 40 MW and annual produced electrical energy should be 120 kWh.

**The main barriers & strategies to overcome them:**

The main barrier for construction of wind power plants in Slovenia is relative high visual influence into space and reduction of possibilities of survival of lynx and wolf on national level. In Slovenia there are appropriate mostly those areas of nature which are protected (Natura 2000). Because of that it is necessary to make precise measurements of wind velocity on selected areas before setting up of each wind turbine. With help of data of wind velocity and their analysis it is possible to make a decision about economic expedience of investments. The smaller barrier is also public opposition. People recognition about wind power plant benefits and refreshment of fossil fuels problem are necessary for public acceptance of wind power plants.

**Short-term perspectives:**

A short-term perspective is realization of setting up of wind power plants on Volovja Reber with common power of 40 MW.

**Mid/long-term perspectives (until 2010):**

Since investment costs fall irrepressible at high production it is estimated that till 80 MW of wind power plants can be set up in Slovenia. Possible locations for setting up of wind turbines are following:

- Gora above Ajdovščina (measure station Sinji vrh),
- Nanos above Vipava (measure station Nanos),
- Banjščice above Nova Gorica (measure station Bate) and
- Dolenja vas.



## Wood biomass

**The past:** Biomass has been used mostly for heating and small size also for electricity production.

**The present:** "Case study about cogeneration on wood biomass in Heating plant Železniki" has been made, where planned spreading of network is already in operation and proposals for reduction of temperature level of the system are investigated.

**The main barriers & strategies to overcome them:**

The main barriers are high investment costs for boilers and cogeneration systems. Because of that a state must subsidise investments. The problem is also the low price of raw material (wood biomass) and un-established wood biomass market. 54 % of Slovenian area is covered with forest but it is not systematically exploited.

**Short-term perspectives:**

Realization of cogeneration system in Heating plant Železniki for which decision about technology (wood biomass boiler + steam turbine) is already accepted.

**Mid/long-term perspectives:**

Exchange of old, big industrial wood biomass boilers with new ones for combined heat and power production and building of new combined heat and power systems. Since investment costs for power plant on wood biomass are very high, it is estimated that power plants of common power of 8 to 10 MW can be built in Slovenia.



## Biogas

**The past:** Generation of electricity from biogas was started in 80<sup>th</sup> years. In this way small power plants started to operate on wastewater treatment plants and dumps.

**The present:** Presently there are three power plants on landfill gas from dumps of 4.55 MW of common power, two power plants on biogas from pig farms of 0.57 MW of total nominal power and four power plants on sewage sludge gas from wastewater treatment plants of approximately 1.8 MW of common power.

**The main barriers & strategies to overcome them:**

The main barrier is public opposition due to many factors. Recognition about biogas utilization benefits is necessary for public acceptance.

**Short-term perspectives:**

A short-term plan is installation of additional two or more gas engines on dumps in Kranj and Celje.

**Mid/long-term perspectives:**

Estimated economic potential from existent dumps, existent and planned waste water treatment plant in cities and animal farms is 10 to 30 MW by the year 2010.



## Small hydro (< 10 MW)

**The past:** The beginning of small hydro power plants production in Slovenia was at the start of 80's stimulated by an Energy Sector Act, which allowed construction of energy buildings also out of electricity management. In this way until attainment of independence the greater part of small hydro power plants was built.

**The present:** Presently big hydro power plants with the capacity of approximately 831 MW and small hydro power plants with the capacity of approximately 155.54 MW are installed.

### **The main barriers & strategies to overcome them:**

The main barrier for building of small hydro power plants is complicated proceeding for taking out of licence and acquisition of building permit. Proprietors of land, which have a priority, do not have interest, knowledge and needed capital. On the other hand investors with references and capital do not have locations with needed permits for building of small hydro power plants. If country wants to build small hydro power plants on the streams or concrete locations then must on the basis of public competition offer those locations to potential investors. Those locations should be defined from point of view of inclusion in space and should have a building licence.

### **Short-term perspectives:**

A short-term perspective is renovation of old hydro power plants.

### **Mid/long-term perspectives:**

As a long-term perspective (2018) is a construction of 5 hydro power plants on Sava: Boštanj, Blanca, Brežice, Krško and Mokrice. Those hydro power plants will double electricity production on Sava.



## PV

**The past:** On the field of solar energy transformation into electricity some PV systems were installed for own supply of Alpine hut with common power approximately 15 kW in Slovenia.

**The present:** A first solar power plant for electricity production with power of 1.1 kW, which is connected to electrical network, was set up in Ljubljana. On the Faculty of electrical engineering and computer science in Maribor a 5.5 kW solar power plant which will be connected to electrical network have started to

operate in the year 2004. The biggest solar power plant in Slovenia (16.3 kW) which is connected to electrical network have started to operate in the year 2005 on the roof of airport Lesce.

### **The main barriers & strategies to overcome them:**

The main barriers are high investment costs. Especially high subsidies are required.

### **Short-term perspectives (until 2005):**

A short-term perspective is setting up of some small independent systems, as well as systems connected to electrical network. However solar power plants will not influence essentially on the share of produced electrical energy from RES.

### **Mid/long-term perspectives (until 2010):**

A long-term perspective is setting up of 3 MW of independent systems as well as systems connected to electrical network.



## OTHER RES-e: Geothermal energy

**The past:** Project for exploitation of geothermal energy (cogeneration) was launched in 1999, but it was not accepted.

**The present:** In Slovenia geothermal energy has not utilized for electricity production yet in spite of 50 to 70 MW<sub>e</sub> of estimated theoretical potential.

**The main barriers & strategies to overcome them:**

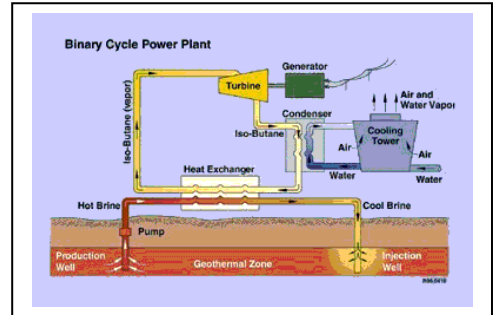
The main barriers are ignorance of technologies and non-interest of companies, which can execute those technologies. Very expensive and lengthy researches are also big barriers.

**Short-term perspectives:**

Short-term perspectives are studies for electrical energy production from geothermal energy.

**Mid/long-term perspectives:**

One pilot-plant for electricity production with power of 5 MW is foreseen.



## **Main market actors:**

The main market actors are companies active in the field of technology production, planners and consultants. Clusters "URE" (efficient energy use) and "OVE" (renewable energy sources) and Cluster solar power plant were established, which vision is to develop cooperation of different type of institution, which can be associated by interest of development of production equipment and electrical energy perspective market in spite of diversity. The basic goal is directed development of domestic science, know-how and specialized equipment and overcoming of the barriers for higher solar energy utilization in Slovenia.

### 1) Most important companies:

- Gryps d.o.o. (delivery of equipment, solar systems installation),
- INEA d.o.o. (delivery of equipment),
- Litostroj E.I. (water turbine production, equipment for hydro power plants and pump stations),
- Turboinstitut (measurements and water turbine development),
- Kon Tiki Solar d.o.o. (regulator production and installation of systems),
- TAB d.d. (factory of storage batteries),
- ETI elektroelement d.d. (industrial apparatus, distribution systems),
- Iskra sistemi d.d. (researching, planning, production, supplying and mounting in energetics),
- public enterprises for electrical energy distribution,
- public enterprises for treatment with waste and electrical energy production from landfill gas from dumps,
- central waste water treatment plants for electrical energy production from biogas,
- farms for electrical energy production from biogas.

### 2) NGO's & other institutions:

- Agency for Efficient Energy Use and Renewable Energy Sources (AURE),
- Energy Restructuring Agency (ApE),
- Center for Energy and Environmental Technologies (CEET),
- "Jožef Stefan" Institute – Center for Energy Efficiency,
- Slovenian Forestry Institute - Department of Forest Technique and Economics,
- Ekowatt d.o.o. (energy advising),
- research institutions,
- Small hydro power association,
- auto-producers.

## Conclusions:

The most utilized energy source for electricity production in Slovenia is water, since there are more than 375 small hydro power plants. Hydro power plants (small and big) represent the highest share among RES and also for the future the highest potential in Slovenia. Beside renovation of old hydro power plants and construction of 5 new hydro power plants on river Sava, the main potential is indicated on the field of combined heat and power from biomass and construction of wind power plants. Due to very high potential of animal waste, a big emphasis will be also given on electrical energy production from animal waste.

In order that auto-producers, which have possibility of electricity production from renewable energy sources, would decide for that, a feed-in tariff system is valid in Slovenia. Prices for individual types of qualified producers respectively types of renewable energy sources are different and depend also on the power of power plant. Realization of that system is relative simple. Government or other competent agency defines a buying price and obligates electrical energy distributors to buy the electricity. Government is also in charge for control of execution.

The sun as renewable energy source represents a high potential for electrical energy production since at solar power plant there are neither influence into space nor visual disturbance of environment. Due to very high investment costs and small system efficiency, electrical energy from these power plants is the most expensive and many times exceeds the price from other power plants on renewable sources. Because of that it is estimated that solar power plants will not influence essentially to the share of electricity produced from renewable energy sources in short-term period.